

25 April 1995

CHAPTER 18

Collection System Rehabilitation

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COLLECTION SYSTEM REHABILITATION

18.1 Purpose

This Chapter does not attempt to detail the physical repair of a collection system, but rather presents a philosophy on the overall procedure for effective rehabilitation. The use of this chapter will guide an engineer in developing a program to "catch-up" in the race against infiltration and inflow, and further provide municipalities guidance in the continuous rehabilitation needed to maintain the system.

18.2 Definition

Infiltration - The volume of groundwater entering sewers and building sewer connections from the soil, through defective joints, broken or cracked pipe, improper connections, manhole walls, etc.

Inflow - The volume of any kind of water discharged into sewer lines from such sources as roof leaders, cellar and yard area drains, foundation drains, sump pumps, commercial and industrial "clean water" discharges, drains from springs and swampy areas, etc.

Infiltration/Inflow (I/I) - The volume of both infiltration water and inflow water found in existing sewer systems. Since the two sources are many times indistinguishable, it is impossible to determine the amounts of either.

Continuous Rehabilitation Program - An on-going rehabilitation effort to identify and repair I/I sources and maintain a collection system.

18.3 General

The Division of Water Pollution Control recommends a broad two-tier approach to sewer rehabilitation. First, the municipality should attempt to "catch-up" the collection system maintenance to a degree such as if the maintenance had been performed steadily over the years. Once the system has been thoroughly rehabilitated to an acceptable level of flow reduction, the municipality should then be prepared to start over again with a program for continuous rehabilitation. The goal of the Continuous Rehabilitation Program is for the system to routinely identify, repair and re-examine their collection system in order to maintain the system in as good condition as possible from now on. The benefit of this approach is to spread the cost of maintenance over the life of the system (by budget) and reduce or slow the rise of the cost per gallon of treatment. Treatment costs are just as high to treat I/I water as they are to treat domestic sewage. Repairing sewage systems and effectively reducing I/I is challenging, difficult and demanding. A successful rehabilitation effort requires both knowledge and persistence. Cities should not wait for grant dollars to begin this effort but should commit resources to begin a program and evolve the program into an effective I/I reduction goal.

18.4 Sub-Basin Approach

Success or failure of a rehabilitation program should not be judged by looking at flows only at the treatment plant. When the flow rate is based on a single point measurement of the system, such as the entrance to the plant, (except for very small collection systems) the increments of reductions are too small to notice for quite some time. The flow is averaged in the overall system as to both infiltration/inflow and flow contributed from sanitary wastes. The one-point plant approach also does not differentiate the intact areas of the system which require no renovation and rehabilitation from the extremely poor areas which would benefit from rehabilitation. The only way to accomplish such a differentiation is to use a sub-basin approach.

Sub-basins are discrete contributing areas of the entire sewer system network which can be isolated and adequately monitored by placing monitoring devices in key manholes. The sub-basin could be an entire drainage area or it could be a small section of a larger drainage basin. The intent of the sub-basin approach is to divide the systems into workable subsections to monitor flow reduction and progress.

The sub-basin also allows rehabilitation costs to be estimated for other similar sub-basins. After repair of the sub-basin, real costs are available in relation to actual flow reduction. This approach is helpful in developing catch-up costs and budget consideration for the cities.

18.5 Sub-Basin Analysis

After dividing the system into sub-basins, each should be analyzed individually, and rehabilitated individually until each basin repair is 100% complete. Do not skip around from basin to basin for points that appear bad. The reason for this is that successful rehabilitation is not usually realized until the last few leaks are repaired. Much work will usually be accomplished with no apparent changes in flow.

One of the causes of this is due to migration. When individual point repairs and joint sealing are performed, infiltration water which once entered the system at the repaired point, migrates along the pipe until another joint or leak is encountered. The water may then enter the pipe, resulting in no flow reduction. For this reason, all points of leakage must be repaired. The old style rehabilitation efforts of repairing leaks of a certain size or leakage rate is useless. Many times, a repair of one large leak will actually allow more water into the system by migration to several small leaks whose total area is greater than the repaired leak.

Basins should be prioritized based upon either visual observations of surcharging, durations and impacts of bypassing, or flow monitoring. If surcharging is present, flow monitors must be of the type to measure velocity at full pipe or the data will be useless. Each sub-basin should follow a three phase repair process as follows in 18.5.1.

18.5.1 Repair Process

Phase I - I/I Source Identification and Location

1. System flow map - sub-basin designations, monitoring points
2. Flow observations and/or monitoring (Base line wet and dry)
3. Line cleaning performed
4. Structural Inspection of manholes
5. Smoke Testing (See Section 18.5.4)
6. TV Inspection (Where needed)
7. Devise a repair work plan
8. Establish budget requirements for Phase II and III
9. Indicate realistic flow reductions anticipated

Phase II - Repair

1. Prepare construction plans

2. Grout, Seal, Replace, Test, etc., as developed from Phase I data for each sub-basin at a time
3. Repair service laterals (see Section 18.5.2)
4. Supervise the work and maintain records
5. Make a "second pass" over the sub-basin locating and repairing remaining I/I sources.

Phase III - Evaluation

1. Monitor wet weather flows, record data
2. Determine I/I reductions
3. Document costs and completed repairs
4. Move to next sub-basin or begin the Continuous Rehabilitation Program

18.5.2 Service Laterals

Working on service laterals cannot be overemphasized. Once the leaks are repaired in the mains, the ground water level in the trench elevates and inundates sections of the laterals. Without repair, the service laterals will leak just as badly as the mains. Using a TV camera during high ground water conditions, crews should attempt to identify leaking laterals. Only the leakers should be inspected further. Most problems are encountered either at the main/lateral junction or within the first six (6) feet off the main. Equipment is available to grout a short section of a service lateral from the main.

18.5.3 Grout and Seal

On grout sealing contracts, the municipality should require the contractor to re-test at least 5% of the joints that were grouted, after the job is complete. If more than one joint between manholes fail, the contractor should pay for the retest and repair. If many roots are present in a line, it is best to dig up and replace the line. Grouting is short-lived where roots are a bad problem. Minor root problems may be treated chemically and then sealed.

Grout selection is very important. Grouts that depend upon the presence of water to maintain their integrity, though cheaper and less toxic to handle, may not be as long lived. If the ground water table drops down below the grade of the sewer long enough for the soil surrounding the sewer line to dry out, these grouts shrink and can leak more than before the grouting was done. The urethane foam grouts are a durable product that will maintain their seal whether water is present or not. The best advice is to talk to a number of manufacturers and weigh the pros and cons on each product.

18.5.4 Smoke Testing

Most leak detection work must be done while it is raining or immediately following a rain. However, smoke testing can be useful during low rainfall seasons for locating roof and area drain connections. Because work is often done at night or under poor working conditions, all manholes should be located and daylighted ahead of time.

Close attention to field procedures is important when conducting a smoke testing program. Each sewer line segment in the sub-basin to be tested should be tested

with a blower at both the upstream and downstream manholes. Blowers should be run at full throttle to obtain the best results.

18.5.5 Other Methods of Repair

Depending upon the problems discovered in the Phase I evaluation, other more involved techniques to rehabilitation may be required. These include:

1. Dig up and Replace - Physical replacement of the line.
2. Sliplining - A rigid liner is pushed or pulled through an existing pipe.
3. Inversion Lining - A reaction-based material is turned inside out through an existing pipe.

With the exception of number 1 above, these techniques are performed by companies or contractors experienced in this type of work. Further data is available from the Division of Water Pollution Control, if needed. See Table 18-1 for presently approved materials for the above methods.

18.6 Continuous Rehabilitation Program

The above techniques apply also to the continuous program. Scheduled monitoring of the system should be performed, along with visual inspections during rainfall events. When problems are encountered, their repair should begin as soon as possible. A budget item is recommended for the program and possibly repair equipment will need to be purchased.

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RDL:E3079053

CHAPTER 18 TABLE 1

The following materials have been previously approved by the STATE OF TENNESSEE as acceptable for use in the STATE:

- 1) 9 April 1991 K M Inliner II (also known as Inliner USA)
- 2) 17 May 1991 U-Liner
- 3) 6 September 1991 Nu Pipe (folded form of Insituform)
- 4) Insituform 1987
- 5) Ultraliner April 1995
- 6) PipeTec Expanda Pipe April 1995
- 7) AMLINER April 1995

CHAPTER 18 TABLE 2

Polyethylene Pipe Size Comparison
for Slip Lining

| Inside Diameter of Original Sewer (inches) | Diameter of Liner Pipe (inches) | Minimum Wall Thickness (inches) | | | | | |
|--|---------------------------------------|------------------------------------|-----------|-----------|-----------|-----------|-----------|
| | | SDR 26 | ID SDR 21 | ID SDR 17 | ID SDR 17 | ID SDR 17 | ID SDR 17 |
| 6 | 4.500 | 0.207 | 4.961 | 0.215 | 4.070 | 0.317 | 4.741 |
| 6 | 5.375 | 0.207 | 4.961 | 0.256 | 4.863 | 0.317 | 4.741 |
| 8 | 6.625 | 0.255 | 6.115 | 0.316 | 5.993 | 0.390 | 5.845 |
| 8 | 7.125 | 0.274 | 6.577 | 0.340 | 6.445 | 0.420 | 6.285 |
| 10 | 8.625 | 0.332 | 7.961 | 0.411 | 7.773 | 0.508 | 7.609 |
| 12 | 10.75 | 0.414 | 9.922 | 0.512 | 9.726 | 0.633 | 9.484 |
| 15 | 12.75 | 0.491 | 11.768 | 0.607 | 11.536 | 0.750 | 11.250 |
| 15 | 13.38 | 0.515 | 12.350 | 0.638 | 12.104 | 0.788 | 11.804 |
| 18 | 16.00 | 0.616 | 14.768 | 0.762 | 14.476 | 0.942 | 14.116 |
| 21 | 18.00 | 0.693 | 16.614 | 0.858 | 16.284 | 1.059 | 15.882 |
| 21 | 18.70 | 0.720 | 17.260 | 0.891 | 16.918 | 1.100 | 16.500 |
| 24 | 22.00 | 0.847 | 20.306 | 1.048 | 19.904 | 1.295 | 19.410 |
| 27 | 24.00 | 0.924 | 22.152 | 1.143 | 21.714 | 1.412 | 21.176 |
| 30 | 28.00 | 1.077 | 25.846 | 1.334 | 25.332 | 1.648 | 24.704 |

APPENDIX A

CHAPTER 18

SECTION 02730

MANHOLE REPAIR AND REHABILITATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Section 01530: Barriers
- B. Section 01560: Temporary Controls
- C. Section 01570: Traffic Regulations
- D. Section 01710: Cleaning
- E. Section 02610: Paving
- F. Section 02722: Sanitary Sewer, Force Main and Appurtenances

1.02 JOB CONDITIONS

- A. Immediately notify the Engineer of any unexpected or unusual conditions. Discontinue work until Engineer provides notification to resume work.
- B. All work in streets and roadways shall be conducted in strict accordance with provisions of Section 01570.
- C. By-pass pumping of sewage will be allowed only as provided in the Project Work Schedule and approved in writing by the Owner.

1.03 QUALITY ASSURANCE

- A. Adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for the proper performance of the work specified in this section shall be used.

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- B. Equipment adequate in size, capacity and numbers to accomplish the work in a timely manner shall be used.

- C. Contractor shall provide adequate on-the-job supervision of all work and workmen to assure the work meets all requirements of the Contract.

1.04 SUBMITTALS

- A. Contractor shall supply a list of all materials proposed for use under this Section including copies of manufacturers descriptive literature.
- B. Submit six (6) copies of the required documents in accordance with Section 01340.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Only materials listed below and/or those approved by the Engineer a minimum of seven (7) calendar days prior to the BID opening will be accepted for use with this project.
- B. All materials and supplies shall be prepared, applied and cured in strict accordance with the manufacturers requirements and specifications.

2.02 REPAIR AND REHABILITATION MATERIALS

- A. Stopping Leak
 1. Foam type grout, "Scotch-Seal 5600", as manufactured by the 3-M Company.
 2. DRYCON-OCTOPLUG as manufactured by IPA Systems, Inc.
 3. PRECO PLUG as manufactured by FOSROC PRECO Industries, Ltd.
- B. Plugging, Smoothing and Filling
 1. OCTOCRETE as manufactured by IPA Systems, Ltd.
 2. DRYCON-OCTOPLUG as manufactured by IPA Systems, Ltd.
 3. PRECO PLUG as manufactured by FOSROC PRECO Industries, Ltd.
- C. Coating and Sealing
 1. PRECO Waterproofing/Sealer (Gray and White) as manufactured by FOSROC PRECO Industries, Ltd.
 2. DRYCON Waterproofing/Sealer (Gray and White) as manufactured by IPA Systems, Inc.

2.03 CLEANING MATERIALS

- A. A "Clean" water for high-pressure washing.

- B. Standard Masonry Cleaning Muriatic Acid Solution for chemical cleaning.

2.04 FLEXIBLE JOINT SEALANTS

Flexible joint sealants for setting and sealing top frames to manholes shall be butyl rubber based material conforming to federal specifications SS-S210A, AASHTO M- 198, Type B- Butyl Rubber and as follows: maximum of 1% volatile matter and suitable for application temperatures between 10 and 100 degrees F.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Remove manhole casting if schedule for repair or replacement, or is loose and requires resetting to seal & pass vacuum test.
- B. Inspect manholes before beginning high-pressure wash to identify scope of work, to confirm actual depth for payment purposed, and to confirm rehabilitation category.
- C. Clean all interior surfaces by hand and with high-pressure “clean” water to remove all loose, deteriorated and/or foreign materials.
- D. Wash all interior surfaces with approved solution of Muriatic or hydrochloric acid.
- E. Repeat Step C.
- F. Chipping smaller cracks and loose material may be necessary to provide proper placement and bonding of plugging materials.
- G. Controlled diversion or bypass pumping of the sewage shall be incorporated if required to accomplish a satisfactory reconstruction.

3.02 MAJOR MANHOLE REHABILITATION

- A. See “Manhole Rehabilitation Log” in the Project Plans for listing of manhole information and categories.

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- B. Major Manhole Rehabilitation shall include complete restoration of manholes in fair to poor condition. Manholes in this category shall have a rating of three (3) or greater for “Physical Condition” and ratings of two (2) or four (4) for “Leaking”.
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- C. Manhole restoration shall consist of:
1. Correct all visible leaks by use of approved hydraulic cement, drilling and pressure grouting (approved grout only) or other approved methods.
 2. Repair, reshape or replace invert area.
 3. Depressions, holes and very rough areas shall be smoothed with hydraulic cement or thickened mixes of synthetic coating material to provide a surface leveled to a maximum of 1/2 inch roughness.
 4. Interior coatings may be applied by "Brushing" or approved "Spraying" methods.
 5. Coat interior surface with one (1) coat of approved white coating material and allow minimum curing time and proper curing conditions.
 6. Apply second (2nd) layer of approved gray coating materials within allowable time to assure proper bond and curing.
 7. Allow recommended final curing time and provide recommended curing conditions.
 8. Re-set or replace frame and cover as specified.
 9. Cast Iron Frames shall be set in a bed of Butyl rubber flexible joint sealant, and secured with anchors as specified and shown in the Project Details.

3.03 MINOR MANHOLE REHABILITATION

- A. See "Manhole Rehabilitation Log" in the Project Plans for listing of manhole information and categories.

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- B. Minor Manhole Rehabilitation shall include complete restoration of manholes in good to moderate condition. Manholes in this category shall have a rating of two (2) or less for "Physical Condition" and ratings of zero (0), one (1) or three (3) for "Leaking".

- C. Manhole restoration shall consist of;
1. Correct all visible leaks by use of approved hydraulic cement, drilling and pressure grouting (approved grout only), or other approved methods.
 2. Repair, reshape or replace invert area.
 3. Depressions, holes and very rough areas shall be filled and smoothed with hydraulic cement or thickened mixes of synthetic coating material to provide a surface leveled to a maximum of 1/2 inch roughness.
 4. Interior coatings may be applied by "Brushing" or approved "Spraying" methods.

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5. Coat interior surface with one (1) coat of approved white coating material and allow minimum curing time and proper curing conditions.
6. Apply second (2nd) layer of approved gray coating materials within allowable time to assure proper bond and curing.

7. Allow recommended final curing time and provide recommended curing conditions.
8. Re-set or replace frame and cover as specified.
9. Cast Iron Frames shall be set in a bed of Butyl rubber flexible joint sealant, and secured with anchors as specified and shown in the Project Details.

3.04 TESTING

A. Manholes shall be physically, and vacuum or hydrostatically tested to assure compliance with the Specification and workmanship of the finished rehabilitation.

B. Manhole Vacuum Test:

1. All manholes shall be physically inspected, and all visible defects repaired before reinspection.
2. All manholes shall be subjected to a vacuum test of a minimum of ten (10") inches of mercury (Hg) prior to acceptance by the OWNER. The test shall be considered acceptable if the vacuum remains at nine (9") inches of Hg or higher after the following times:

| | | | | | | |
|-------------------------------|----|----|----|-----|-----|-----|
| <u>MANHOLE I. D. (inches)</u> | 48 | 60 | 72 | 84 | 96 | 120 |
| <u>SECONDS</u> | 60 | 75 | 90 | 105 | 120 | 150 |

C. Exfiltration Test

1. Manholes shall be subjected to an exfiltration to a minimum of ten (10) minutes. The test shall be considered a success if the water level in the manhole filled to the lid seat of the frame remains within one (1") of the starting level for the specified time of ten (10) minutes.
2. The manhole shall be plugged and filled to the test level for a period of fifteen (15) minutes prior to the test to presoak the manhole materials. The water level shall be returned to the specified level before beginning the test.

D. Testing Sequence:

1. All manholes shall be physically inspected and vacuum tested. Manholes failing the test shall be repaired by the CONTRACTOR, and retested.

2. Manholes failing the vacuum test two (2) times may, at the discretion of the OWNER, be allowed to be hydrostatically tested by an exfiltration test for acceptance.
3. The OWNER may require complete replacement of any manhole failing three (3) leak tests. Replacement shall be at no cost to the OWNER.

E. The CONTRACTOR shall furnish all equipment and personal to conduct the tests in the presence of the ENGINEER.

F. Costs for all testing shall be included within and incidental to the Contract Unit Price for manhole repair and rehabilitation.

G. Repairing, retesting, pressure grouting and/or replacement of defective shall be at the sole cost and responsibility of the CONTRACTOR, and shall be pursued in a timely manner to prevent disruption to the Project and/or sewer services.

H. Manholes moved, displaced and/or damaged in any way during finishing and/or backfilling operation subsequent to successful testing shall be retested for acceptance as specified above, at the sole cost of the CONTRACTOR.

END OF SECTION

SECTION 02731

MANHOLE RECONSTRUCTION BY LINING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Section 01530: Barriers
- B. Section 01560: Temporary Controls
- C. Section 01570: Traffic Regulations
- D. Section 01710: Cleaning
- E. Section 02610: Paving
- F. Section 02722: Sanitary Sewer, Force Main and Appurtenances

1.02 JOB CONDITIONS

- A. Immediately notify the Engineer of any unexpected or unusual conditions. Discontinue work until Engineer provides notification to resume work.
- B. All work in streets and roadways shall be conducted in strict accordance with provisions of Section 01570.
- C. By-pass pumping of sewage will be allowed only as provided in the Project Work Schedule and approved in writing by the Owner.

1.03 QUALITY ASSURANCE

- A. Adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for the proper performance of the work specified in this section shall be used.
- B. Equipment adequate in size, capacity and numbers to accomplish the work in a timely manner shall be used.
- C. Contractor shall provide adequate on-the-job supervision of all work and workmen to assure the work meets all requirements of the Contract.

1.04 SUBMITTALS

- A. Contractor shall supply a list of all materials proposed for use under this Section including copies of manufacturers descriptive literature.
- B. Calculations:
 - 1. Contractor shall supply calculation for thickness(es) for each manhole scheduled for reconstruction by lining methods.
 - 2. Contractor shall secure Engineer's approval prior to beginning work.
- C. Submit six (6) copies of the required documents in accordance with Section 01340.

1.05 PATENTS

The Contractor shall warrant and save harmless the Owner and Engineer against all claims for patent infringement and any loss thereof.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Only materials listed below and/or those approved by the Engineer a minimum of seven (7) calendar days prior to the BID opening will be accepted for use with this project.
- B. All materials and supplies shall be prepared, applied and cured in strict accordance with the manufacturers requirements and specifications.

2.02 LINING MATERIALS

- A. Leak Stopping and Plugging Material - Type "A"
 - 1. Foam type grout, "Scotch-Seal 5600", as manufactured by the 3-M Company.
 - 2. DRYCON-OCTOPLUG as manufactured by IPA Systems, Inc.
 - 3. PRECO PLUG as manufactured by FOSROC PRECO Industries, Ltd.
- B. Plugging, Smoothing and Filling Materials - Type "B"
 - 1. OCTOCRETE as manufactured by IPA Systems, Ltd.
 - 2. DRYCON-OCTOPLUG as manufactured by IPA Systems, Ltd.
 - 3. PRECO PLUG as manufactured by FOSROC PRECO Industries, Ltd.
- C. Coating and Sealing Materials - "C"
 - 1. MATERIALS: SPRAYWALL URETHANE as distributed and applied by Insituform Corporation.
 - 2. CHARACTERISTICS: The cured urethane system shall conform to the minimum physical standards, listed as follows:

| | | |
|------------------|------------|-------------|
| TENSILE STRESS | ASTM D-638 | 5,000 psi |
| FLEXURAL STRESS | ASTM D-790 | 10,000 psi |
| FLEXURAL MODULUS | ASTM D-790 | 550,000 psi |

2.03 CLEANING MATERIALS

- A. A "Clean" water for high-pressure washing.
- B. Standard Masonry Cleaning Muriatic Acid Solution for chemical cleaning.

2.04 FLEXIBLE JOINT SEALANTS

Flexible joint sealants for setting and sealing top frames to manholes shall be butyl rubber based material conforming to federal specifications SS-S210A, AASHTO M-198, Type B- Butyl Rubber and as follows: maximum of 1% volatile matter and suitable for application temperatures between 10 and 100 degrees F.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Remove manhole casting if schedule for repair or replacement.
- B. Inspect manholes before beginning high-pressure wash to identify scope of work, to confirm actual depth for payment purposed, and to confirm rehabilitation category.
- C. Clean all interior surfaces by hand and with high-pressure "clean" water to remove all loose, deteriorated and/or foreign materials.
- D. Wash all interior surfaces with approved solution of Muriatic or hydrochloric acid.
- E. Repeat Step C.
- F. Chipping smaller cracks and loose material may be necessary to provide proper placement and bonding of plugging materials.
- G. Controlled diversion or bypass pumping of the sewage shall be incorporated if required to accomplish a satisfactory reconstruction.

3.02 MAJOR MANHOLE REHABILITATION

A. See "Manhole Rehabilitation Log" in the Project Plans for listing of manhole information and categories.

B. PREPARATION:

1. Leaks and flowing water into the manhole shall be plugged and approved - Type "A" materials and techniques.
2. The manhole invert shall be replaced and/or repaired, and voids, depressions and deep rough areas around pipe entrance and in the manhole walls shall be repaired to provide a leveled surface to maximum of 1/4 inch roughness.

C. LINING APPLICATION:

1. Lining system may be applied to damp, but not wet surfaces.
2. The lining shall be applied by approved appropriate spray techniques to the interior manhole surfaces by trained/experienced technicians.
3. The liner placement shall be in strict accordance with methods approved prior to beginning the work.
4. The finish liner thickness(es) shall be in accordance with the calculated required thickness(es) to a tolerance of minus 0/8 th inches to plus 2/8th inches.
5. Replaced existing or new manhole frame and cover shall be completed prior to placement of the liner to allow the liner to be applied continuously over the frame up to the lid seat.

3.03 CLEAN-UP AND TESTING

A. Physically inspect all manholes and repair all visible defects.

B. Manhole Vacuum Test:

1. All manholes shall be subjected to a vacuum test of a minimum of ten (10") inches of mercury (Hg) prior to acceptance by the OWNER. The test shall be considered acceptable if the vacuum remains at nine (9") inches of Hg or higher after the following times:

| | | | | | | |
|-------------------------------|----|----|----|-----|-----|-----|
| <u>MANHOLE I. D. (inches)</u> | 48 | 60 | 72 | 84 | 96 | 120 |
| <u>SECONDS</u> | 60 | 75 | 90 | 105 | 120 | 150 |

2. Manholes failing the test shall be repaired and inspected by the Engineer, and then retested. Should the Manhole fail the test for a total of three (3) failures, the manhole shall be repaired by pressure grouting the exterior and/or removing the previous applied repairs and beginning the reconstruction process again.

3. The CONTRACTOR shall furnish all necessary equipment and personal to conduct the tests in the presence of the ENGINEER.

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4. Costs for initial testing shall be included within and incidental to the Contract Unit Price for manhole reconstruction.
5. Repairing, retesting, and/or pressure grouting defective manholes shall be at the sole cost and responsibility of the CONTRACTOR, and shall

be pursued in a timely manner to prevent disruption to the Project and/or sewer services.

6. Manholes moved, displaced and/or damaged in any way during the finishing operations subsequent to successful testing shall be retested for acceptance as specified above, at the sole cost of the CONTRACTOR.

END OF SECTION

APPENDIX 18A

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Appendix 18-F

SEWER REHABILITATION PRIORITIES

Priority I

- Point Repair, Replace or Liner - to stop active water flow.
- Lines located in the immediate area of storm sewers or ditches.

Priority II

- Point repair or liner to seal or repair offset joints, root intrusion, broken pipe leaking noted, but no active flow noted.
- Lines located in areas not adjacent to storm sewers or ditches.

Priority III

- Lines that did not exhibit the number and/or severity of problems noted for Priorities I or II at the time of investigation.

Priority IV

- Lines found to be in good condition the time of investigation.

SECTION 02750

SEWER RECONSTRUCTION BY SLIP-LINING METHOD

PART 1 - GENERAL

1.01 REQUIREMENTS

- A. Reconstruction of sewer lines by installation of a continuous polyethylene (PE) liner or folded form of polyvinyl chloride (PVC) inserted into an existing sewer.
- B. The finished pipe shall be continuous from manhole to manhole and be sealed at the beginning and ending manholes.

1.02 RELATED DOCUMENTS

- A. Section 01310: Construction Schedules
- B. Section 01340: Shop Drawings, Product Data and Samples
- C. Section 01530: Barriers
- D. Section 01560: Temporary Controls
- E. Section 01570: Traffic Regulations
- F. Section 02221: Trenching, Backfill and Compaction
- G. Section 02722: Sanitary Sewers, Force Mains and Appurtenances

1.03 SUBMITTALS

- A. Submit certified product data for:
 - 1. Polyethylene Pipe
 - 2. Folded Form of PVC
 - 3. Sealing Rope
 - 4. Foam Type Chemical Grout
 - 5. Couplings
 - 6. Service Saddles
 - 7. Silicone Adhesive
 - 8. Rapid Setting Hydraulic Cement
- B. Submit six (6) copies of required documents in accordance with Section 01340.

C. Submit six (6) copies of the proposed construction schedules within fourteen (14) calendar days of the Notice to Proceed.

D. Submit testing and inspection data as outlined in this Section.

1.04 REFERENCES

A. ASTM 03350